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(71) Applicant and
(72) Inventor: CROOKSHANKS, Rex, J. [US/US]; 1901 Paseo del Sol, Palos Verdes Estates, CA 90274 (US).

(74) Agent: DULIN, Jacques, M.; Innovation Law Group, Suite 815, 111 North Market Street, San Jose, CA 95113 (US).

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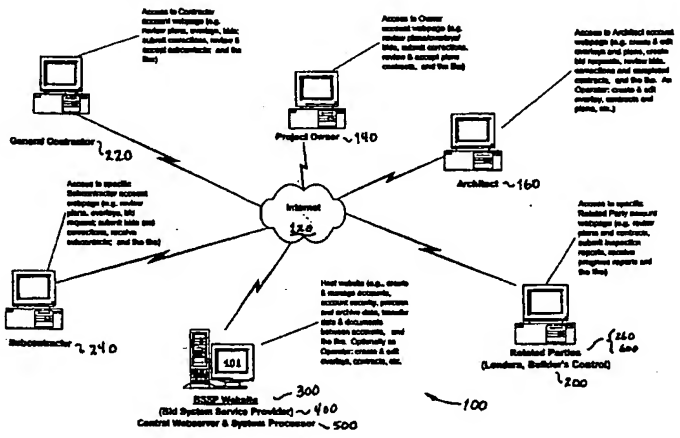

(57) Abstract: The present invention relates to a system and method ("Bid System") for topologically subdividing and defining the detail scope of work and for inter-linking construction plans and specifications to construction contracts and subcontracts. The Bid System permits full, clear and unambiguous definition of the scope of work under each subcontract, so as to eliminate errors and uncertainty relating to contract performance. The Bid System establishes a series of electronic overlays to the digitized construction plans corresponding to different trades or categories of work, in which each overlay may be divided into a series of optimized topological subdivisions or "boxes" which uniquely identify and locate on the plans a portion of the work to be performed. The system includes linkage of the overlays and boxes to the subcontracts whereby the scope of work to be bid is accurately associated or "mapped" to corresponding regions and overlay category on the architectural drawings or construction plans. This mapping of overlays to plans constitutes a system of almost-orthogonal equations having the property of progressively increasing transparency as the typical size of the subdivisions is reduced. The system and method also permits a bi-directional flow of information from the various entities involved in the bid process so as to enhance the clarity and detail of work description of both the contracts and the plans and specifications, thus permitting more efficient and effective monitorng and management of contract performance.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Internet-based embodiments of the Bid System of the invention are described, including a central-server remote host Internet embodiment in which the transmittal of data, including plans, overlays, contracts, bids, comments, edits, changes and the like are via the Internet, the Bid System being operated principally on a central remote host operated by a Bid System Service Provider (BSSP). Distributed host Internet embodiments are also disclosed.

BUILDING CONSTRUCTION BID AND CONTRACT MANAGEMENT SYSTEM, INTERNET-BASED METHOD AND COMPUTER PROGRAM THEREFOR

DESCRIPTION

RELATED APPLICATION:

This provisional application is related to, and claims the priority of, the following United States Provisional Patent Applications by the same inventor as the present application: Application No. 60/137,576, filed June 4, 1999; Application No. 60/163,702, filed November 5, 1999; Application No. 60/174,989, filed January 7, 2000, and Application 60/197,907 filed April 13, 2000. These prior applications are incorporated herein by reference.

TECHNICAL FIELD:

The invention relates to computer-assisted construction bidding and contract administration, and in particular to a system and method for topologically subdividing and defining the detail of the scope of work and for inter-linking construction plans and specifications to construction contracts and subcontracts. The system and method employs a system of almost-orthogonal equations which permits increasing the detail specificity of the work scope as the degree of sub-division of the plans increases, thus eliminating errors and uncertainty relating to the performance of construction contracts. The system and method also permits a bi-directional flow of information during the bidding process and construction process so as to enhance the clarity and detail of work description of both the contracts and the plans and specifications, thus permitting more efficient and effective monitoring and management of contract performance. The system of the invention includes a method of Internet-based electronic project management services for developers, owners, contractors and sub-contractors, architects, financial institutions, and related affiliates for the design, construction and financing management of construction projects.

BACKGROUND:

The construction industry is one of the cornerstones of the US and world economy. For example, in 1997 the construction industry in the US for more than 500 billion dollars of GNP. More than 200 billion dollars are spent on the construction of new dwellings each year.

A substantial portion of the cost of construction is due to the expenses of cost estimation, the administration of the bidding process, contract and sub-contract management, generating documentation needed for financing, and allowances for contingencies. In addition,

major cost increments are frequently experienced due to errors in cost estimation, mistakes in bidding, and in dispute resolution with respect to contract obligations, performance responsibility and change orders. Indeed, it can be said that major cost overruns are more typical than not. It has been estimated that such contingencies and problems add 30% or more to the overall cost of the work, and resultant schedule delays cause further consequential losses. Given the enormous size of this sector of the economy, the cumulative inefficiencies, errors and uncertainties in the construction bidding process and in the administration of construction contracts represent a very important source of lost economic value to society.

A particular problem in the traditional approach to construction contract bidding, cost estimation, and management of contingencies stems from the inability to sufficiently detail the work description. In the existing approach to bidding, the plans and specifications are circulated with a description of the work to be bid to the respective subcontractors to price a portion of the work. Each subcontractor then estimates labor, material and administrative costs and profit based on the scope of work required. Each subcontractor's estimation of the scope of work is influenced by the subcontractor's own interpretation of the plans and specifications, and is based also on each subcontractor's assumptions as to the respective performance responsibilities of the general contractor and the many other subcontractors. Mistakes and inconsistencies of interpretation of the plans and the scope of each bid are difficult, if not impossible, to avoid in traditional bidding.

Experience has taught contractors and subcontractors to add very substantial allowances to the bid price for the resulting contingencies, uncertainty, delays and dispute resolution costs. Likewise, owners and lenders of necessity also must allow for these contingencies and uncertainties, increasing the cost of capital and loan administration. In addition, the traditional bidding process does not provide an effective opportunity to correct errors, omissions and ambiguities in the plans and specifications prior to submission of the bids and awarding of contracts. Further, and of increasing significance, is the slow, by-hand and by-phone process of exchange of bid and contract management documentation and information.

These problems are manifest in spite of architect-prepared plans and sound engineering practice. Even where computer assisted design ("CAD") drawing and specification systems are employed, experience shows that there remains real uncertainty as to *exactly what* aspects of the project work are the responsibility of *which* subcontractor, and *exactly how* much labor and *exactly what* materials will be required for *which* subcontractor's performance. Likewise, portions of the scope of work which are inadvertently excluded form the subcontracting bids create additional contingencies and uncertainties for the general contractor, and controversies,

often expensive and protracted, sorting out responsibility and liability for work and payment of costs.

If each bidding contractor and subcontractor could know that the work bid could be completed at a given bid price, there would be little need for contingency bidding. Likewise, an accurate and completely detailed description of the work being bid or constructed would assist in preventing or quickly resolving disputes concerning contract obligations and performance.

If information generated during the bidding process could be interactively channeled back and forth between the general contractors, architects and owners before the finalization of the contracts, many mistakes and ambiguities in the plans and specifications could be corrected in time, e.g., prior to contract let, to avoid change orders and disputes. When post-contract changes to the plans or specification are required due to circumstances which are unforeseeable at the time of bidding, a completely detailed description of the change of scope of work, and of the extent of needed modification of the general contract and each subcontract would allow such change orders to be managed quickly and fairly.

What is needed, and is not present in the prior art, is an interactive, computerized system and method, preferably communication enabled via the Internet, LANs or WANs, for controlling the construction bidding and contracting process to provide a certain and complete description of the scope of work required under each contract and subcontract so as to avoid inconsistencies, omissions, ambiguities and mistakes in the interpretation of plans and specifications, and for the ongoing management of the financing, and construction management phases of the project. What is also needed, and not present in the prior art is a means and method for systematically linking the construction plans and specifications to the bid and contract generation process so as to provide an interactive, bi-directional flow of information to increase the accuracy, completeness and clarity of both the contracts and the plans.

SUMMARY-Including Objects and Advantages of the invention:

This present invention provides an interactive, systematic topological approach to solving the problems of the traditional bidding process, and its integration into an Internet-based construction management business. The invention includes a computerized, Internet-based building construction bidding and contract management system and method (herein generally referred to collectively as "Bid System").

The Bid System of the invention establishes a series of "overlays" to the construction plans, in which each overlay corresponds to a different trade or bidding category of work. The

overlay provides a representational "surface", aligned and oriented to the plans, upon which the detail nature of the work to be performed in a particular trade or category may be precisely topologically defined. The work in the overlay category contained in the plans is defined and functionally segregated by establishing selected topological subdivisions or of the overlay corresponding to the locations of the plan elements requiring the particular category of work.

The Bid System further includes linkage of the overlays and defining topological subdivisions to system-generated forms of contracts and subcontracts. By means of this linkage, the scope of work to be bid under the contract is accurately associated or "mapped" to corresponding subdivision regions and overlay category on the architectural drawings or construction plans. In other words, the overlay subdivisions provide a work scope definition which is incorporated by reference to define a specific contract obligation.

The Bid System of the invention permits full, clear and unambiguous definition of the scope of work to be bid under each contract and subcontract. By this means, all the parties involved in the various phases of the project, primarily including but not limited to, the lenders, architects, contractors, sub-contractors and owners (also referenced herein as the "client") know precisely what is required in each sub-contract. The systematic linkage of the construction plans and specifications to the bids and contracts generated by the system permits the early detection and correction of errors, omissions, ambiguities or inconsistencies of the plans, thus providing a bi-directional flow of information to increase the accuracy both the contracts and the plans.

Other objects and advantages will be evident from the description, drawings and claims.

Bid System Principles

From a mathematical perspective, the Bid System and method of the invention, including the set of overlays containing identified regions mapped to specified corresponding regions of the plans and specification on a one-to-one basis, employs a system of almost-orthogonal equations, which provide the following functionality. Any such function which is non-singular, and which has one-to-one mapping point-to-point, has the property that the smaller the surface area of the region (provided the function is continuous on the region), the greater the transparency. Thus, as the area of the region specified is reduced, the degree of precision increases and the potential degree of ambiguity decreases. As the topological subdivisions of the overlays are progressively refined through the operation of the method of the invention, a mathematical limit is approached wherein the potential ambiguity tends to zero. Consequently, the mapping of overlays to plan comprises a system having the property of progressively increasing transparency as the typical size of the subdivisions is reduced.

Thus, under the system and method of the invention, the size and boundary location of each subdivision may be selected to obtain the degree of specificity needed to ***completely*** identify and define the scope of work for any given element of the project work. Accordingly, it is possible to use the Bid System of the invention to identify, ***without ambiguity***, the entirety of the scope of work called out in the plans and specification. In other words, it is possible to use the Bid System to specify 100% of the scope of work of the project, not just 99.9%. In practical terms, this means that the Bid System may be readily adapted to any specialty work or category of services or components of the construction project, both routine and non-routine in nature, and still obtain complete specificity of the scope of work required under any subcontract.

The method of the invention is preferably carried out by means of a computer-based digital Bid System including a conventional computer system (with conventional processors, memory, input/output and display devices) which is suitably programmed to carry out the present inventive method. However, the functional steps of the method of the Bid System of the invention may also be carried out by a combination of manual and computer operations.

The following description will focus on application of the method to sub-contractor bidding, it being understood that the steps may also be carried out with respect to the various other project phases and requirements, including financing, permitting, management of the project during construction, and indeed, to the initial conceptual design phase.

Plans, Drawings and Specifications

The Bid System is compatible with conventional architectural, engineering and construction plans, drawings and specifications currently used in construction projects. The Bid System is also compatible with conventional CAD systems, and the system includes means for file import, export and conversion. The primary input to the Bid System is preferably a complete set of conventional architectural or construction drawings, preferably including any engineering notes, bills of materials, custom features, items or designs, or other specifications provided with the drawings (these documents may be referred to collectively herein as the "drawings", "plans" or "plans and specifications").

The plans may be scanned in from paper sheets by a conventional digitizing scanner so as to create a computer-readable digital data file. The term "plan sheets" may be used to denote herein either the paper or electronic image form of the drawings, as the context indicates. Alternatively the plans may be imported (and converted as needed) from conventional computer-readable CAD or other electronic files. Optionally, the Bid System may include a CAD module to allow the preparation, editing, correction and revision of drawings directly without additional distinct import/export/scanning operations. Regardless of

the means of input, the term "plans" or "drawings" will be used herein to denote the computer-readable form of the plans or drawings, unless another meaning is indicated by the context (for example, plans and contracts printed as "hard copy").

Plan Overlays

Following input of the plans, a categorical series of virtual overlays are created as digital data for each plan sheet. Preferably, the overlay series is stored as one or more digital file(s) in computer readable medium. Each individual overlay is geometrically coordinated with and associated with a specific sheet of the plans. Each virtual overlay represents a particular category of building trade or bidding sub-contract category.

In essence, the overlay is a virtual surface, aligned coordinate with the plans, upon which plan specification information pertaining to a specific trade or bid category may be defined, extracted or refined, distinct from other plan information, for example, by enclosing pertinent plan features in closed boundaries (which can be referred to as "frames"). Thus the overlay is a representational object for segregating plan information related to a particular trade category.

The digital or virtual overlays are analogous to transparent sheets which can be superimposed on paper drawing sheets, so that subdivisions may be drawn on the overlays to mark data or drawing features mapped to specific regions or locations on the plans. For simplicity and clarity, this physical "transparency and paper" analogy will frequently be used herein to describe certain steps of the method of the invention. However, it is noted that, unless the context indicates otherwise, the steps are preferably carried out electronically using software embodiments of the Bid System invention, conventional computer means, and conventional peripheral devices, such as displays, mouse type devices, light pens, keyboards and the like, to establish pertinent information in the form of computer-readable data. The plans and overlays are preferably transmitted electronically in the Internet-based business method aspects of the invention.

The term "trade", as used herein with respect to the plan overlays and the corresponding bid categories, includes traditional building and construction trade categories. The term "trade" in this context can also include any other category of work, services or materials indicated by, or related to, the plans and specifications which the bid system operator, general contractor, architect, lender, insurer, permitting or inspecting the agency, or owner determines is advantageously assigned to a distinct work or bidding category. This can include work to be reserved to the owner or postponed to future projects. As many different categories may be established by the operator as are needed to completely bid the project.

Establishment of Overlay Subdivisions

The topological subdivision regions which refine and define the scope of work are created upon the overlays by a number of exemplary method embodiments of the invention. Regardless of the particular method or methods used to establish the overlay subdivision, each subdivision is preferably identified by a unique code and preferably also has a displayable icon associated with it. The identification code and icon ("identifiers") provide a cross-reference between the contracts and bid documents which list/display such identifiers and the overlay subdivisions which define the work to be performed.

Where a particular plan element spans more than one subdivision within an overlay (i.e., boundary-piercing elements), each such subdivision may have associated annotations defining the continuation of such element to adjacent subdivisions,

In both computer display and in printed hardcopy, the overlay subdivisions may be shown as a highlighted or shaded region, and displayed or printed superimposed upon the plans. In its computer displayed form, each such subdivision may be "clickable" so that a mouse or other input device can trigger the display of associated information relating to the subdivision, such as defining coordinates, annotations, and cross-referenced contract and bid documents as described further below. Preferably the user may click to open a menu of such options, and select the desired display options.

Overlay categories may be color or pattern coded for printing and computer display, to permit convenient viewing of more than one overlay category superimposed on the plan sheet simultaneously.

Overlay Box Subdivision Embodiment

In one embodiment of the Bid System of the invention, the work described in the plans is defined by the establishment, on each relevant overlay, of a system of subdivision regions, each of which is enclosed by a user-defined closed boundary, frame, or "box", so that each such box identifies, delimits and locates on the plans a portion of the project work to be performed. Each such enclosed region or box includes within its closed boundary a finite portion of the scope of work to be bid under the particular trade contract, i.e., that enclosed work portion is accurately associated or "mapped" to the corresponding boxed regions and overlay category on the architectural drawings or construction plans. Thus, the "box" work scope definition is incorporated by reference to define a specific contract obligation.

The Bid System user or operator draws or defines "boxes" on each overlay, over each part of the respective plan sheet which corresponds to the particular subcontract category for the overlay. Each box is preferably defined by a plurality of ordered pairs of coordinates, and by lines connecting these coordinate pairs to form a closed box perimeter or boundary. The coordinate system may be centered with respect to any convenient reference point on the plan

sheet, and preferably is based on a conventional rectangular coordinate grid, but other conventional coordinate systems such as radial coordinates may also be used. The boxes are not limited to any particular shape and the lines connecting the coordinate pairs are not limited to straight lines, and may be other geometrically defined curves.

However, as the term "boxes" implies, boxes composed of a plurality of straight lines defined with respect to an orthogonal coordinate system are generally preferred for simplicity, operator convenience, and consistency with conventional building plans. The scale of the coordinate system may be in arbitrary units, or may adopt the scale and units of the plans. Reference grid scales may be superimposed on the borders of the overlay for viewer convenience, in the manner of conventional street map coordinate grids.

The Bid System may optionally be applied to 3-dimensional box definitions, and the grid system can include 3-dimensional coordinates, preferably as ordered orthogonal triplets (although spherical coordinates may be used). However, since the conventional plans used in construction are generally organized as 2-dimensional representations, the 2-dimensional embodiment of the Bid System is described in detail herein.

It is preferred that the region defined by a given box of a category not overlap with another box of the same category, such as a box-within-a box. While the overlap does not prevent the job from being bid properly as long as duplication is avoided, it is desirable to have each box within a category uniquely define a plan region, so that completeness and non-duplication can be proven topologically.

Note that the operator may also preferably draw boxes over any part of a plan sheet not having work covered by the particular overlay category, and these non-category boxes ("empty boxes") may have no icon or be assigned an icon indicating the absence of work associated with a category. Optionally, an error detection algorithm may be included to check to ensure no portion of the plans was inadvertently neglected by the operator, i.e. was not boxed. There may also be boxes defined by subtraction, i.e., a larger region minus one or more small boxes within or encroaching into portions of it. The foregoing procedure is preferably then repeated for the work category with respect to each sheet of the plans, and repeated with respect to each designated work category. Thus, preferably each sub-contract category will have an overlay with boxes for each plan sheet, and corresponding icons assigned by the bid engineer.

Once the boxes are created on each overlay sheet corresponding to a particular category, a form of contract or sub-contractor bidding agreement may then be read in from a contract forms database. Alternatively, a suitable contract form may be scanned in or imported into the Bid System. The Bid System preferably includes conventional word-processing and/or image processing software modules to permit the creation of custom contract forms or the

editing of contract forms submitted by a particular owner or vendor. The contracts forms includes paragraphs or sections in which the detailed scope of work required is described with reference to the boxes.

The subdivision of the plans into overlays and boxes in the Bid System is particularly advantageous in situations where work in a given trade category is to be divided between more than one entity, which ordinarily exacerbates the risk of confusion using traditional bidding procedures. This may occur, for example, where the general contractor and a subcontractor divide a particular category of work, or if owner-supplied fixtures etc. are to be installed by a subcontractor. In these circumstances, the specifically bid, box-defined work portions serve to avoid misunderstanding as to the limits of the role of each party. Also, boxes and/or distinct overlay categories may be established to distinguish and define non-contract work or materials which are specified in the plans. Examples are work to be completed by the owner (detailed as an "owner-work" boxes), or work to omitted form the initial phase of construction (detailed as an "postponed improvement" boxes).

Alternative Exemplary Overlay Subdivision Embodiments

In addition to the overlay box subdivision embodiment, the topological overlay subdivisions which refine and define the scope of work may be created upon the overlays by a number of alternative exemplary method embodiments of the invention, described below.

Like the overlay box subdivision embodiment, each of these alternative embodiments establish in the overlay a subdivision and/or segregation of the plan information related to a bid category so as to permit linking to contracts, bids and other documents, but each includes alternative subdivision methodology. The various overlay subdivision embodiments described herein may be used alone or in combination with each other.

Object Trace Subdivision Embodiment

In an alternative embodiment of the Bid System of the invention, the work described in the plans is defined by the establishment, on each relevant overlay, of a system of trace paths covering plan elements pertinent to the corresponding trade or category. Each trace path defines a contiguous surface region of the overlay (and corresponding aligned plan sheet). Each overlay may have as many trace paths as are necessary to completely define the bid category work. Each trace path is thus a representational object on the overlay corresponding in extent and general shape to the plan element or elements.

Each trace path includes a trace centerline, which may include both straight and curved portions. The trace centerline may also be branched. The trace path also includes overlay/plan area within a pre-defined distance perpendicular to the trace centerline (trace breadth). The

trace path is thus represented geometrically in the plan ordinate system by a series of contiguous line and curve segments, intersection points and trace breadth parameter.

The trace paths are preferably created by moving a pointing device (such as a mouse cursor, input stylus or other conventional computer user input device) over a display of the digitized plan sheet, so as to establish in computer memory a geometrically defined curve. The trace path method of overlay subdivision is particularly suitable for distributed kinds of plan or trade elements, such as ducting, plumbing, wiring conduits and the like. The trace path can be established quickly and intuitively for such elements. In both computer display and in printed hardcopy, the trace path may be shown as a highlighted or shaded region.

Zoom View Subdivision Embodiment

In an alternative embodiment of the Bid System of the invention, the work described in the plans is defined by the establishment of scaled or "zoom" view definitions upon the overlay. The zoom view subdivisions are similar to the subdivision boxes described above, but are not defined by a particular closed curve, but rather are represented by a center point and a geometrically defined area about the center point. For example, a zoom view may be defined as a circular area having a defined radius about the center. Alternatively the zoom view is a rectangular area of predetermined height and width about the center point.

The zoom view subdivisions are conveniently displayed or printed as enlarged views of the original plan sheet, and may be defined or scaled to fit the shape of a page print area or screen. The scale of the enlargement (corresponding to the defined radius or height/width of the zoom view) permits detailed plan information to be conveniently printed/displayed, such that the entire printed/displayed portion falls within the subdivision.

Grid Block Subdivision Embodiment

In an alternative embodiment of the Bid System of the invention, the work described in the plans is defined by the establishment a comprehensive grid of overlay blocks. The work is then defined by specifying the particular grid blocks which encompass the work to be included in the category. The size of the grid blocks is preferably standardized for all overlays linked to the plan sheet, and the standard size may be preselected to permit a desired degree of selectivity. The grid block identifiers may correspond to row and column headings, such as are typically used in maps and spreadsheets.

Functional Overlay Drawing Subdivision Embodiment

In an alternative embodiment of the Bid System of the invention, the drawing data pertaining to a work category is subdivided by extraction/segregation from the plans and insertion into the corresponding overlay. Thus the overlay, following extraction, comprises a functional subdivision drawing including the category work. Since the overlays as defined

herein are representational surfaces coordinately aligned with the drawing sheets, particular drawing information may be extracted or copied to an overlay of that sheet without loss of contextual information. The data on the overlay may be matched or mapped to identical data on the plans. The overlay is linked to contracts, bids and other documents as described herein to define the scope of work of the overlay category.

In the functional drawing subdivision embodiment, as many overlay categories may be established as are needed to extract all work to be performed in the project. In addition, if reserved or non-project plan elements are extracted to an appropriate overlay category, then a summation file of the overlays for a particular plan sheet may be compiled, preferably with both plan sheet and summation in a comparable digital format. A cross correlation or comparison between the summation file and the plan sheet is preferably performed to determine that no element of the plans has been inadvertently overlooked (completeness check functionality).

The extraction of plan data to the overlay is preferably performed by conventional computer user graphical interface tools and devices, such as are conventionally employed in graphics applications. For example, drawing elements may be graphically selected, grouped and copied to a corresponding location and orientation in the overlay. The functional drawing subdivision embodiment is particularly suitable for use in connection with CAD design applications, whereby a computer-readable CAD file is the input form of the architectural plans to the Bid System computer.

The Bid System may be readily adapted by one skilled in the art to recognize and manipulate drawing elements of the CAD plans drawing as defined in any conventional CAD file format. Similarly, where a particular CAD system permits the architectural plan sheets to be compiled as a series of drawing layers, the bid system subdivision process may include selecting one or more layers of the CAD file, importing the layer to the overlay file, and performing additional selection and editing, if needed, to limit the data elements in the overlay to those relevant to the corresponding trade category.

Linkage Of Overlays To Contracts, Bids And Project Documents

The Bid System can generate forms of contract or bids, and update, archive and revise the contracts throughout the various stages of bidding and project work. The terms "contract" and "bid" as used herein refer to such sequential stages or versions of a contract document, even though the legal nature and significance of the document typically changes as the bidding and subcontracting process proceeds. At the outset, the "contract" or "bid" may in fact be simply a non-binding invitation to subcontractors to make offers on the defined portion of the project or work. Later when priced and submitted by the subcontractor, the "contract" or "bid"

may become an offer. Finally when accepted by the general contractor and owner, the "contract" may become a legal obligation to perform work at the bid price. The particular legal nature indicated by the terms "contract" and "bid" is to be interpreted in light of the context and project stage.

The description of the bid contract generation method herein uses as an example the Box Overlay Subdivision Embodiment described above, but the method applies equally to the alternative overlay subdivision embodiments. The operator links each paragraph or section to the corresponding parts of all the drawings by listing next to each, the appropriate icons on each box of each drawing overlay (assigned in the above paragraph). In the electronic form of these documents, the icons may include hyperlinks for easy viewing and cross-reference between the drawing and corresponding contract portions. The icon may include a distinctive and easily recognizable logo or symbol in combination with box reference codes which is easy to distinguish from conventional architectural elements and notations of the plans. If desired, different icon logos or symbols may selected to be indicative of a particular category or trade of the box.

The complete subcontract with icons, the drawings, and the overlays can then be printed out for review by the client and/or architect, and any necessary corrections made by the operator using the Bid System. In general, the printed form of both plans and contracts will be referred to herein as "hard copy". Any non-category or empty boxes can also be identified in the print out so that the architect and client may ensure that those areas were not simply missed by them in drawing up the contract. The process is repeated for each subcontract category.

These sub-contracts can then be printed with the drawings and overlays (the overlays may be printed on transparencies, or directly superimposed on the plan printout). In this manner, all parties can readily inspect the sub-contracts and determine exactly what is required (from looking at the same icons which appear on both the contracts and overlays). Sub-contractors can enter a price on these sub-contracts and initial or digitally sign each page, to complete a bid. The signed (or initialed) sub-contracts are saved into the system for archival purposes.

Note that the entire contract with all subcontracts, icons, and drawings and iconized overlays, can also be provided to the client (for example on a CD-ROM, or by modem download) with icons being hyperlinked for easy jumping between an overlay box on a drawing sheet, and a corresponding paragraph or section of the contract.

Change Orders And Plan Modifications

The Bid System and method is usefully and profitably used for the initial bidding stage of a construction project alone. However, the same features and functionality that lends its use

to this stage, makes it very suitable for use through the entire project time line. For example, since the overlays and boxes are mapped to a pre-defined coordinate system, revised plans or sheets, if required at any project stage, may be submitted by the architect or owner without the necessity of re-drawing the boxes. The substitute sheets may be imported, and saved (preferably after archiving the previous plan version) and existing overlays may be coordinated with the substitute plan sheets. Only the specific plan revisions need to be checked to see whether new boxes need to be created, or existing boxes need to be modified. Change orders can then be generated quickly and efficiently based on revisions by the method described for initial contracts.

Bid System Service Provider

In the preferred embodiment and method of the invention, the Bid System is operated by a dedicated service provider, referred to herein generally as a Bid System Service Provider (BSSP), which provides the support, software, hardware, and trained personnel to carry out all, or selected aspects of, the method of the invention. Even more preferred the BSSP may operate the system over the Internet, this comprising of an Internet-based project management system and method.

Alternatively, the operation of the Bid System may be de-centralized to a selected degree. For example, the function of analyzing plans, creating overlays and contract/bid documents and entering corrections to these documents are alternatively performed by an architect, general contractor, owner, or other person, or by a combination of these persons operating the system sequentially or interactively (in general, the "bid engineer" or "Operator"). A BSSP may still perform a wide variety of functions even when the Operator function is carried out by another party. As discussed below in connection with the various system embodiments and alternatives, the BSSP may function to archive data, maintain database services for the benefit of other construction-oriented enterprises such as lenders, insurers, brokers, realtors, attorneys, and title companies. In addition, the BSSP preferably provides software licensing, training, technical support and consulting services to other Operator parties, such as an architectural firm, including an ongoing hotline and service support.

Project Management Information

The method of the invention may be carried out in phases during a project timeline, defining at appropriate stages the contractual obligations, scope of work and deliverables for the various persons and entities participating, such as architects, consultants, engineers, general contractors, and subcontractors. The Bid System may also include inputs and outputs from or to various entities such as building code inspectors and building control services monitoring

progress on behalf of lenders. The Bid System includes defining and generating original bids and contracts, and also generating change orders which become necessary during construction. The method may also include importing data and contracts for project-related contractual services not specified in conventional architectural plans, such as waste removal, security services, and the like, followed by editing, bidding, and/or archiving these contracts within the Bid System.

The data import, interlinking, document creation, archival storage, database and communications are under control of one or more computer programs which are coded to perform the functionalities described herein.

The data import and interlinking steps of the Bid System method also may be used to import other information for project administration and monitoring purposes ("project documents"), such as progress reports, scheduling data, building inspector punch lists, and the like. The project documents can be subdivided and assigned overlays and/or icons by category in the manner described above with respect to source records. These icons can then be associated and interlinked with the corresponding finalized subcontracts. Reports or displays may then be generated to present contract information in functional association with other relevant project information.

The system and programs of the invention also provide for electronic archival storage of both the plans and the contracts at various stages of the bidding and construction process, and provides for the preparation of as-built plans and the amendment of contracts to include change orders.

Plan/Overlay/Subdivision Linked Relational Database

The operation of the Bid System method of the invention typically includes the compilation of a database (the Bid System preferably includes a relational database management system and programs) which comprises data pertaining to the plans, the overlays, and the overlay subdivisions (e.g., boxes). The data is linked to other data fields pertaining to project documents (e.g., contracts for owner, architect, contractor and subcontractors) as well as other project data such as timetables, regulatory approvals, inspections, checklists and the like.

The operation of the method of the Bid System also provides program capability for updating such data in the database on an ongoing basis through out the project timeline, and logs the history of reviews, changes, completions, communications, and the like.

Because this plan/overlay/subdivision linked database structure is relates the precise work description for each trade category (overlay/box data) to project documents and project status, this database is singularly useful for other project related processes, such as builder's

control, project cost accounting, lender's controls, and the like. As many additional data fields may be created in the database as are needed to relate the project data to these industrial requirements and controlled and secure data access may be provided to third parties needing access to the database.

For example, a construction lender may access database fields that relate the project budget to the contract cost, preferably on an overlay-by-overlay and box-by-box basis. These database fields may be correlated with fields which log builder's control reports and building inspection check-offs, also on a an overlay-by-overlay and box-by-box basis. This database structure thus can give the lender exceptionally precise confirmation of the expenditure of loan proceeds and the completion of project milestones.

Electronic Bidding

The Bid System also permits fully electronic bidding, and may include means whereby suitably equipped subcontractors may view the contracts as computer-readable downloads, enter prices and other information, and submit bids by disk, modem, network or other remote linkage (preferably with conventional electronic communication security and verification provisions). The accepted bids may then be printed, initialed, signed, and archived. In a electronic-bidding embodiment of the Bid System, plan features or fixtures within a box may be highlighted and hyperlinked to footnotes, bills of materials, checklists or other boxes (as with "box piercing" items). These enhancements may also be included in embodiments for use with "hard copy" bidding, for use in internal error checking and operator convenience.

Internet Embodiments Of The Bid System Method And Software

Internet access and connectivity may be included in a number of ways as an element of the Bid System of the invention. Internet embodiments of the Bid System preferably are centered on a Bid System Service Provider (BSSP) which operates a proprietary website. The inclusion of Internet functionality may be integrated with the Bid System operation to various selected and differing depths or degrees, and such integration may be phased in time, as the BSSP becomes progressively established as a business. In addition, the functional differences in the exemplary Internet embodiments described below are not mandatory, a selected features and functions described in reference to one embodiment may optionally be including in another.

In addition, many of the BSSP functions described below with respect to Internet-based embodiments are equally valuable when included in off-net Bid System embodiments.

First, support and marketing Internet embodiment. In a first Internet embodiment of the Bid System of the invention, an Internet website may be created and operated by the preferred Bid System Service Provider (BSSP) to provide a range of business support and

Fig. 8 shows the box creation and annotation sub-method. In this example, the BSSP creates boxes upon each overlay corresponding to and defining the position of drawing elements relevant to the overlay category/subcategory. Relevant box annotations are included, e.g., material specifications and the like, and to cross-reference and define the continuity of box-piercing elements which are also elements included in adjoining boxes. The BSSP completes entries for each box of each overlay. The date that this is completed is logged/saved.

Fig. 9 shows the box/overlay review sub-method. In this example, the BSSP creates a hard copy of the overlays superimposed on plans, and transmits this to the client and/or for review. Optionally the BSSP may export an equivalent electronic file viewable by the client. Preferably, this is via a project webpage assigned and available on the website 300, in Fig. 23. The client comments and corrections to the overlays/boxes are transmitted to the BSSP. Any clarification or plan changes that the client requests of the architect and/or any changes that the client requests in the overlays and boxes may documented by the BSSP on as addendum form, which is created logged and linked in the project database. Note that the architect optionally may also review the overlays/boxes recommendations in consultation with the client at this stage (see **Fig. 13** re architect plan clarifications).

Fig. 10 shows the Owner/Contractor Bidding Agreement sub-method. In this example, the contractor (220 in Fig. 23) is hired by client to collect all bids for the project and an Owner/Contractor Bidding Agreement is signed by each party and transmitted to the BSSP. This contract is imported into system database, logged, saved, and a job-specific icon is attached to this agreement.

Fig. 11 shows the Contractor plans/overlays/box review sub-method. In this example, the BSSP creates a hardcopy of the plans/overlays/boxes and transmits this to the contractor for review. Any changes in the box definitions desired by the contractor or requests for clarification are transmitted to the BSSP. Any changes or clarification that the contractor requests may documented by the BSSP on as addendum form, which is created logged and linked in the project database. Additionally and optionally, the contractor requests may be reviewed and approved by the client and/or architect at this stage.

Fig. 12 shows the box and overlay edit and modification sub-method. In this example, the BSSP modifies the boxes and overlays according to the client/architect/contractor review instructions, if needed.

Fig. 13 shows the architect plan clarification and modification sub-method. In this example, the BSSP prints hardcopy of the plans with the addendum requests of client and contractor. The BSSP delivers plans to architect with points of clarification required by client

and contractor on their respective addendum sheets. The date is logged. Architect makes clarifications to plans per addendum sheets. The architect prepares a final addendum, which becomes a permanent part of the plans (and by inclusion, part of the contract). Architect returns amended plans and addendum to the BSSP. The architect's addendum is imported and logged by the BSSP. Note: "Addendum" is used to mean clarifications to the original plans without drawing changes (see plan modifications in **Fig. 18**). Optionally, the architect may make drawing corrections at this stage also.

Fig. 14 shows the final plans printing sub-method. In this example, the BSSP may make adjustments to box/overlay system as needed per changes and or clarifications by Architect (see sub-method of **Fig. 12**). These are logged into system. A hard copy of plans with overlays is output and logged.

Fig. 15 shows the client final review and acceptance of the plans. In this example, the BSSP creates hardcopy of the final plans and delivers to client for review. The client reviews plans and overlays and either asks for further clarification (see **Fig. 12**) or signs statement of acceptance for this version of overlays and boxes, and returns to the BSSP. The acceptance is then imported logged and linked.

Fig. 16 shows the contractor final review and acceptance of the plans. In this example, the BSSP creates hardcopy of the final plans and delivers to contractor for review. The contractor reviews plans and overlays and either asks for further clarification (see **Fig. 12**) or signs statement of acceptance for this version of overlays and boxes, and returns to the BSSP. The acceptance is then imported logged and linked.

Fig. 17 shows the logging of the acceptance of client and contractor. In this example, the BSSP creates and logs the document of Fig. 15 and 16 (reviewed and accepted addendum sheets and amended plans) into the system. The BSSP links the boxes to the contract by means of the Bid System icon. Plans with overlays and related contracts are output to hard copy.

Fig. 18 shows the subcontract bid generation and distribution sub-method. In this example, the BSSP generates the subcontract bid documents, e.g., using bid system database, including the plans/overlays/boxes, subcontract templates, and project information. Contractors receive from the BSSP a package of plans with overlays and related sub-contracts. The acceptance of these items is logged into the system. The contractor undertakes the task of meeting with potential subcontractors (240 in Fig. 23), distributing the bid documents to respective subcontractors and collecting bids for each sub-contract as outlined in owner/contractor bidding agreement.

If any sub-contractor requests clarification from architect, these requests are noted on supplemental addendum form. Contractor completes initial meetings with all sub-contractors,

if there are requests for clarification, all materials are returned to the BSSP, who logs this into system. At this point there are no signed bids. All items for clarification from sub-contractors are transmitted to the architect, via a Subcontractors Addendum/Clarification Document. This date is logged into system. The architect addresses requests for clarification, makes changes on plans accordingly. Architect returns revised plans to the BSSP. This is logged into system.

The BSSP checks to see if clarifications/changes by architect require changes in box system. If definition and parameters of any boxes are changed (see **Fig. 12**), then all associated subcontracts may be changed also, and all links (with icon) are adjusted accordingly.

Fig. 19 shows the final subcontract bid distribution sub-method. In this example, the BSSP makes a determination that the current version of plans, contracts and overlays is complete. The BSSP then saves and logs this version into system, and outputs hard copy of plans with overlays. Revised plans/subcontracts overlays are transmitted to contractor and the date is logged into system. The contractor in turn transmits the plans/subcontracts to subcontractors to obtain signature from sub-contractors for all subcontracts. The contractor returns signed subcontracts to the BSSP, and this date is logged. The signed subcontracts are preferably scanned into system database by the BSSP as project records.

Fig. 20 shows the final contract review and confirmation sub-method. In this example, the BSSP generates hard copy of all subcontracts, along with inserted copies of "intermediate" pages, as defined in Owner/Contractor Agreement. In this phase, builder's control provisions may also be inserted per the Owner/Contractor Agreement. These delineate the timing and sequence of the interaction between the Builder's Control and the Contractor and Builders Control and the owner. All pages are numbered in sequence, the final hard copy is transmitted to contractor, and the date is logged.

The contractor acknowledges/comments on the sequence of construction for the project in the documents. Contractor checks subcontract documents for accuracy, adds his fee to the document, and returns documents to Bid System. The date is logged. The owner and contractor review all subcontract documents, and place signatures on completed documents, and return to the BSSP.

Signed subcontract documents are logged into Bid system for archive. A hard copy of each subcontract is given to owner and contractor along with CD-ROM.

Fig. 21 is a class diagram of a preferred and exemplary embodiment of the Bid System of the invention, which breaks down the preferred method of operation into smaller components that focus on real world objects. These exemplary objects are easily translated into computer-readable code written in conventional object-oriented programming languages, such as C++ or Java. The sequence diagrams of **Figs. 4-20**, in turn tie the objects of the class diagram of **Fig. 21** with the steps shown in **Table 1**. **Table 1**, included in the **Appendix**, is a logical view chart of the exemplary objects and operations depicted in the sequence diagrams of **Figs. 4-20** and the class diagram of **Fig. 21**, giving descriptions which set forth the properties of the objects.

Fig. 22 is a diagram of a central-server remote host Internet embodiment of the Bid System **100** of the invention. In this embodiment, the transmittal of data, including plans, overlays, contracts, bids, comments, instructions, review status, edits, changes and the like is preferably via the Internet **120**. The Bid System is preferably operated principally on a central remote host server **101** which is maintained and operated by the Bid System Service Provider (BSSP) **400** i.e., the software elements are principally or wholly resident on the BSSP servers **101**, which host on-line processes and off-net processes. Each of the other linking parties may access the BSSP website 300 by means of a conventional Internet browser software running on conventional PCs. For each project party, the BSSP via the central server may create an account, with appropriate conventional security and authentication controls, which allows that party to access particular BSSP website pages supporting the functions of that party in the Bid System method. The website software preferably manages the interaction of each such party through links to related pages, and by response pages. The central server **101** controls data exchange between parties by authenticating data inputs, internally processing data as appropriate to the method step, storing and archiving data, and transferring data to the account pages of other parties to the project, and communications between it and the parties, and inter-parties, as needed.

The website-based workflow management functions preferably includes linking, via the BSSP website and BSSP processing functions, the interaction of at least the following parties involved in the operation of the Bid System method:

Bid System Service Provider 400: **Host** and manage BSSP website **300** (e.g., create & manage accounts, account security, process data with Bid System software and archive data, transfer data & documents between accounts, prepare and process billing and receipts, and the like. Optionally as Operator, create & edit overlays, contracts, etc.).

Owner/developer **160:** Access to Owner account webpage (e.g. review plans/overlays/bids, submit corrections, review & accept plans contracts, and the like).

Architect **103:** Access to Architect account webpage (e.g. create & edit overlays and plans, create bid requests, review bids, corrections and completed contracts, and the like. As Operator, create & edit overlay, contracts and plans, etc.).

General Contractor **220:** Access to Contractor account webpage (e.g. review plans, overlays, bids; submit corrections, review & accept subcontracts; and the like).

Subcontractors **240**: Access to specific Subcontractor account webpage (e.g. review plans, overlays, bid request; submit bids and corrections, receive subcontracts; and the like).

Related parties **260** (e.g., Builder's Control 200, engineers/surveyors 180, lending institutions): Access to specific Related Party account webpage (e.g. review plans and contracts, submit inspection reports, receive progress reports and the like).

The website on-line connectivity may be supplemented by automatic BSSP server-generated e-mail or fax messages to the project parties, in addition to conventional communications between the parties. Automatic e-mail messages may be used to queue parties to log-on to their respective account pages when data/documents are ready for their review or further processing. This may greatly simplify the interactions of the various parties in terms of time schedules and the like, particularly in the case of subcontractors who may not be available (do to on-site work) during typical business hours. With the increasing availability of wireless technology, Internet connectivity will be increasingly available at project site locations.

The centralized server permits the parties to avoid the expense and risks of maintaining specialized software and sensitive data on a plurality of servers. The central host website permits data transmission delays to be minimized, as each party need only transmit its specific inputs, and download only that data with is actually to be viewed by that party. Since, each party (other than BSSP) need only have available a conventional Internet capable personal computer, the range of parties who may contribute to the Bid System process is extremely broad. Due to its centralized operation by a professional service provider, the BSSP server may be economically made highly secure in terms of unauthorized access and in terms of data loss. The website on-line connectivity may be supplemented by automatic BSSP server-generated e-mail or fax messages to the project parties, in addition to conventional communications between the parties

Computer System. The method of the present invention can be executed on the conventional computer hardware which use conventional operating systems by means of software running on a suitable processor (in particular, a processor of a general purpose digital computer), or by any suitable combination of hardware and software. The software can be accessed by a processor using any suitable reader device which can read the medium on which the software is stored.